

BACTERIA IN THEIR RELATION TO HEALTH AND DISEASE*

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OBSERVATIONS regarding the occurrence of bacteria in cases of *typhoid fever* resulted in 1880 in the establishment of the fact that this disease is due to a definite bacillus, called Eberth's bacillus (*B. Typhosus*). These bacilli possess a lively voluntary movement produced by flagella arranged along the sides of the rods. The typhoid bacillus is rather hard to differentiate from some other bacilli. It has been found that milk is a good medium for these bacilli and that they can live and even increase in water. This fact is of importance in tracing the origin of any case of typhoid fever. Lower animals are not susceptible to the disease. As you are all aware, doubtless, typhoid bacilli leave the body only in the excreta. Epidemics of the disease can occasionally be traced to pollution of the water or food supply by typhoid discharges. An instance of such tracing to its source is narrated in the text-books of medicine. This epidemic of typhoid occurred in Plymouth, Pennsylvania. In the spring of 1885 a disease broke out there which before it ceased affected twelve hundred persons, causing one hundred and thirty deaths. At first the character of the disease was not known, but it was later found to be typhoid fever. The epidemic was traced to one case which occurred during January, February, and March in a house on a hill sloping towards a water supply of the town. The dejections were thrown out on the snow and the ground underneath was deeply frozen. On March 25 a sudden thaw occurred, and the water, not being able to sink into the frozen ground, ran off on the surface to the town's water supply. On April 10 the epidemic began. It was also shown that those who used some other source of water supply were spared the disease.

But as Dr. Abbott, of Philadelphia, has well said: "There is no task within the scope of sanitary work that is ordinarily beset with more difficulty and uncertainty than the tracing of an outbreak of typhoid fever to its exact source." One reason for this is that suspicion is rarely or never directed to the water supply until the epidemic is in full progress or on the wane. As the period of incubation of typhoid fever seems to vary from fourteen to twenty-one days, the organisms which caused the epidemic may have disappeared from the water supply by the time it is

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subjected to examination. Another reason is the great difficulty, and at times impossibility, of identifying this bacillus when present with other similar bacteria outside the human body.

The infectious nature of diphtheria is so manifest, and its spread from patient to patient so easy and direct, that it has long been regarded as a disease due to specific micro-organisms. As the blood and internal organs are largely free from bacteria in this disease, it was soon concluded that there must be an essentially local process whose action in the system is produced by absorption of poisonous excretions of bacteria at work at the local site of the disease. But the mouth and mucous membranes of adjacent regions normally teem with various kinds of bacteria, and when any part becomes diseased the number of bacteria increases rapidly. Hence search for the bacterium of diphtheria was unusually difficult. To Löffler is due the credit of finding this particular bacillus (*B. Diphtheriæ*). Löffler's bacilli have been proved to occur regularly in diphtheria and to occur only in this disease. Finally, the disease has been produced in animals by means of these bacilli, so that the proofs are complete. These bacilli have no spores and perish rather slowly when dried. Many investigators are of the opinion that the specially severe cases of diphtheria owe their malignancy to a mixed infection, other bacteria assisting the Löffler's bacilli in their attack upon the system.

III. SEPSIS AND ANTISEPSIS.

For a long time it has been recognized by thoughtful surgeons that the majority of processes retarding the healing of wounds are to be attributed to external influences. With the advances made in the study of bacteria it became extremely probable that these micro-organisms were at the bottom of the trouble.

Lister, an eminent English surgeon, came to this conclusion before it had been demonstrated, and to him belongs the honor of having originated the modern antiseptic treatment of wounds. To be sure, Lister himself has abandoned many of his original antiseptic measures as greater knowledge has been obtained, but the principle remains the same and with him must remain the credit. Since the introduction of antiseptics the really severe wound-poisonings, such as "hospital gangrene," have nearly disappeared, and to-day the ideal of the surgeon is to have his wounds heal without suppuration. The study of suppuration by the bacteriologist soon resulted in the dictum, "No suppuration without bacteria." The correctness of this assertion was afterwards disputed, and it was shown that many germ-free chemical substances, such as nitrate of silver, can produce an acute suppuration in the subcutaneous

tissues. But for all practical purposes the dietum stands. Under natural conditions suppuration in man is always to be regarded as a special reaction of the tissues to the presence and activity of micro-organisms.

There are half a dozen varieties of bacteria which produce suppuration, nearly all of them being micrococci. One in growing produces an orange-yellow color from which it takes its name (*Staphylococcus Pyogenes Aureus*). Others which produce blue or green pus show these colors in growing in pure cultures (*B. Pyocyaneus*). Another is white, and still another lemon yellow (*Staphylococcus Pyogenes Albus* and *Citrus*). One of these bacteria is the exciting cause of puerperal fever.

It should be stated that these pus micrococci are found most abundantly where people are crowded together in dirty places. They are not destroyed by drying, and hence may float with dust in the air. When hospital wards and operating-rooms are kept clean, however, wounds are in far more danger of infection from unclean hands and instruments than from the air.

Dr. Oliver Wendell Holmes, when quite a young physician, long before bacteriological science had demonstrated the fact, became convinced that puerperal fever was caused by a poison that could be carried from one childbed to another by the physician or nurse. Of course, he knew nothing of the nature of the germ, which we now grow in test-tubes and label with a long name, but he urged his views with such persistency and accompanied them with such an overwhelming mass of facts that in spite of ridicule he carried the day. As the result of his labors, to-day hundreds of women are confined in squalid tenements without a death from puerperal fever where the confinement is conducted under antiseptic precautions. What general surgery owes to Lister, obstetrics and humanity owe to the Autocrat of the Breakfast Table.

I do not wish to weary you with the details of the development of antiseptic surgery since its birth in the brain of Sir Joseph Lister. They would be interesting only from a historical point of view and of little practical importance to you. I can only give you a few facts, mainly the results of recent investigations.

We have already seen the importance of having the room in which an operation is to be done or a dressing changed as clean as soap and water can make it and as free from dust as possible. Until recently surgeons were somewhat careless about external dirt, owing to their implicit confidence in solutions of the bichloride of mercury. But we now know that this confidence has been somewhat misplaced. Solutions of the bichloride of mercury, when put in contact with living tissues or fluids of the body, rapidly became inert by the formation of harmless compounds with albumin. They are cleansing to a wound, but not any more so than sterilized water.

Cultures of pathogenic bacteria have been made from hands soaked in the 1 to 1000 solution. The originator of the permanganate of potash and oxalic acid method of cleansing the hands, Dr. Howard Kelly, of Baltimore, announced later that it does not destroy all of the pus-producing organisms. Carefully conducted experiments in the New York Hospital have led them to return to the 1 to 1000 solution of the bi-chloride for cleansing the hands, but with this precaution: each finger—every part of the hand and forearm—is treated as though it were the field of operation. First scrub most thoroughly with hot water and good soap. Cut the nails and scrub again. Finally, scrub every part with the 1 to 1000 solution, taking about five minutes for this last scrubbing. This gives the best results, although, as stated, germs have been found even after this preparation. For this reason rubber gloves are now so generally worn by operating surgeons and dressers. Of course, after the hands have been thus prepared they should not touch anything that has not been sterilized. This is the part that is most apt to be forgotten by the careless. All instruments, towels, sponges, dressings, etc., should be sterilized by steam. For the disinfection of dressings that have been used there is nothing so thorough as boiling—except burning. If it be absolutely essential that an article should be disinfected by chemical means, it should be left for several hours in contact with a strong solution of chlorinated lime (six ounces of lime to a gallon of boiling water). This solution should be freshly prepared when needed.

In concluding this brief sketch of a new and already prominent department of medical knowledge I wish to emphasize a few facts which are apt to be too little considered by many: I mean the application of the principles of antiseptic to medical practice. It is a too common mistake to imagine that antiseptic is a department of surgery exclusively. I can safely say that it is of far greater importance to humanity that the physician and his nurse understand the theory and practice of antiseptic than that the surgeon should. From the facts we have already considered about the relation of bacteria to disease—and I have not by any means exhausted the list of infectious diseases—you can understand how it is possible to stamp out many terrible diseases by the application of our knowledge to the prevention of their spread. We have seen how hospital gangrene, smallpox, and puerperal fever have been thus practically stamped out—diseases which at one time quite commonly closed hospitals by killing all their patients.

You know what a terrible scourge pulmonary tuberculosis is, and yet if it were possible to apply to every consumptive the rules of antiseptic treatment,—isolation and disinfection,—the disease would ultimately cease to exist. But the obstacles to this plan are apparent and at present

seem insurmountable. The best we can do—and this should be done in every case—is to isolate the patient as completely as his social relations will permit and then *burn all his sputum*. This doesn't mean to have him use the sanitary sputum-boxes an hour or two a day and the rest of the time use his handkerchief or the sidewalk or the public floors as a receptacle for his sputum. He should never expectorate except into the sputum-box. If he coughs into his handkerchief, it should be immediately burned, and the hands which touched it disinfected in the 1 to 1000 bichloride of mercury solution. His clothing, bedding, towels, etc., should frequently be disinfected by steam, and his cast-off clothing should be burned. His living-rooms should never be dusted, but the dust should be wiped up with damp cloths, which should then be burned. Fresh air and sunlight should be freely admitted. The rooms should frequently be scrubbed with hot 1 to 1000 solution, and when vacated should be thoroughly cleaned, aired as many days as possible, and then completely renovated. In recent years the establishment of State sanatoria and municipal hospitals for consumptives has done much to educate the public in the matter of the proper care of a patient suffering from tuberculosis of the lungs.

In typhoid fever, Asiatic cholera, cholera morbus, and the like absolute isolation is not essential, though desirable. As the source of contagion is in the excreta, these should be disinfected by continued contact with a fresh solution of chlorinated lime or by being covered with a boiling ten per cent. solution of sulphate of iron, which would act as a deodorant as well as a disinfectant. All bed and body linen should be disinfected by steam or boiling. The hands of the attending nurse should be frequently disinfected in the 1 to 1000 bichloride of mercury solution. She should be especially careful about touching her face or hair or any article of food with unclean hands.

In diphtheria isolation should be absolute until the Löffler bacillus can no longer be found in the air-passages. All discharges from the mouth and nose should be received in cloths to be burned immediately. The excreta should also be disinfected. All dishes, utensils, linen, etc., should be disinfected before leaving the sickroom. The nurse should be especially careful to keep clean and should spend as much time as possible each day in the open air.

In scarlet fever, measles, chicken-pox, and other infectious diseases in which the bacterial origin, though probable, has not yet been demonstrated the rules of isolation and disinfection already given should be rigidly enforced. In those diseases in which the skin is involved the patient should have a daily anointing with carbolized vaseline or other antiseptic lubricant to prevent the epidermal scales becoming a part of

the dust of the air. It is highly probable that these scales carry the germs of the disease and so may be a means of spreading the infection. The rule laid down by Dr. F. Cramer, of Wiesbaden, if rigidly enforced, would go far towards limiting the spread of all contagious diseases. It is, "Nothing must come out of the sickroom that has not been disinfected."

THE CARE OF AN OBSTETRICAL PATIENT *

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FROM a nurse of my experience a didactic lecture seems a little out of place, but one thing I know, that private nursing is in many ways very different from hospital work, and the nurse who lacks adaptability, who cannot make a china basin do duty as a bedpan, who cannot protect the bed with baked newspapers when sterile pads are not available, who is so afraid of doing a servant's work that she cannot rise to almost any occasion,—that nurse is not going to be a competitor to be seriously considered.

The obstetrical outfit which we are taught to consider necessary is not by any means indispensable, and I've observed that the surgeon with the newest knife is not always the one that makes the straightest cut. It's a good thing to have all we want, if we can get it; but there are a great many times when it is the part of wisdom not to want too much.

We like to think that the trained nurse in obstetrical practice has won her way over every competitor, but if it were so we would all become specialists in midwifery, since babies are born every minute and the demand for our service would be unending. Here among ourselves we may acknowledge that there are very many misguided mothers who still are not convinced that an exacting, expensive graduate is more to be desired than the experienced helper who tides over her patient with more comfort if with less science. Training will not take the place of sympathetic common-sense, and if we hold our own over our many rivals it will be because, and only because, we make of ourselves from every possible stand-point a very present help in time of trouble. As Oliver Wendell Holmes has expressed in rare verse:

"To give the draught that cools the lips that burn,
To fan the brow, the weary frame to turn,
Kindness untutored by our grave M.D.'s.
But Nature's graduate whom she schools to please

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